**HYPOTHESIS**

Given the current level of development in the scientific fields of health, engineering, biology, and the social sciences, it is possible for humans to travel to and inhabit Mars.

**INTRODUCTION**

This poster will explore whether we have the knowledge and resources to colonize and survive on the barren Martian wasteland. We will present the technology necessary to travel to Mars and back safely and efficiently. We will examine the problems that low gravity and radiation may cause in the human body and present solutions. The poster will present the challenges for a self-sufficient living environment for humans on the surface of Mars. It will also assess potential societal structures of a Martian colony and whether or not we as a species are ready to explore Mars to begin with.

**TRANSPORTATION**

NASA is currently developing a spacecraft, Orion Multi-Purpose Crew Vehicle (MPCV, Figure 1), which will be capable of making it beyond low Earth orbit (LEO). Through increasingly challenging missions, NASA plans to use Orion to travel to Mars. In 2014, Orion will undergo an orbital flight test. It will be launched more than 3,600 miles into space unmanned. For more information about Orion, visit NASA’s website www.nasa.gov.

**SOCIAL**

**Attitudes about Space Travel**

UB students were surveyed about their attitudes concerning space travel and otherworld colonization. The survey results are shown in Figure 2. Note that students are much more willing to train as an astronaut, go into space, and live on the Moon than they are to live on Mars.

**BIOMES**

**Space Travel**

We used the Mars-500 experiment as a model for human travel to Mars. The Mars-500 experiment was conducted at the Russian Academy of Sciences’ Institute of Biomedical Problems in Moscow to simulate the travel from Earth to Mars. The 520-day experiment ended on November 4, 2011. While data is still being analyzed, it appears that psychosocial pressures from the 17-month isolation were tolerable.

**Mars Colony**

We used the experiment Biosphere 2 (a self-sustaining ecosystem set up in Arizona) as a model for a human habitat on Mars. Biosphere 2 experiment operated continuously for two years (1991-1993) as a completely self-sustained ecosystem (see Figure 3). However, the mission was stopped because of low oxygen levels. The low oxygen levels were thought to be due to respiration from soil microorganisms. In addition, psychosocial problems (including the formation of factions) were observed (see Social section).

The Biosphere 2 experience suggests that a short-term colony on Mars may be possible. Significantly, the mission is employed. Problems that arise from being in zero-gravity exceed our current methods of resupply. Adaptation for disease, famine, and technological malfunction is mandatory, so the colony should not be able to function without all members.

The Government

Colony residents require that each colonist will be in charge of a certain field with cross-training between fields. As seen with the Biosphere 2 project, long-term isolation can lead to interpersonal conflict, a breakdown of society, and finger-pointing. It is proposed that fewer conflicts will occur as a hierarchy in expertise is employed.

In an environment where split decisions are needed, democracies may be too slow. It is recommended that the leader be empowered power through a constitutional anachy.

**HEALTH**

**NASA’s Biocapsule**

The biocapsule is a device developed by NASA for the delivery of drugs and cells. It releases drugs slowly and efficiently to the body as needed. In theory, it can release treatments for exposure to radiation into the bloodstream slowly over time. Those drugs include potassium iodide (KI) and glutathione (GSH). Both drugs are currently used on Earth to treat people that have been exposed to radiation. KI only prevents the thyroid from exposure and GSH detoxifies the body to prevent cancers. Scientists are also examining the use of sea vegetables, which contain substances that bind to radioactive particles and allows the body to remove them.

The biocapsule is the size of a pencil tip. It can be implanted under the skin, most likely in the thigh. Biocapsules are made of carbon nanotubes.

Dealing with zero-gravity is also an issue for astronauts. Anabolic steroids and insulin-like growth factor-1 (IGF-1) therapy can be used to prevent muscle-loss in the areas of the body that would normally be used for walking (e.g. the legs and hips). High protein/calium diets are also useful in preventing muscle and bone-loss, but not completely. Exercise using elastic bands helps to strengthen the muscles, but results in poor hygiene. The astronauts have to use chamois cloths to bathe and shower.

**DISCUSSION**

Human exploration of space is possible. However, the specific goal of getting humans to explore and colonize Mars is not yet attainable. Challenges include:

- Health threats
  - The constant threat of radiation and space problems that arise from being in zero-gravity exceed our current methods of treatment. Biocapsules may offer a treatment alternative in the future.

- Biome construction
  - Martian biomes would take too much time and too many trips to finish.

- Public attitudes
  - Our survey results suggest that the general public is not very excited about travel to Mars or about living there for an extended period of time.

**SOURCES**

- www.astronaut.ucf.edu/pubs/2012/12/1244751573/ Would-You-Make-a-Good-Astronaut
- www.spacepolicy.org/hi/health/habitat-research.html
- www.nasa.gov/exploration/systems/mpcv/index.html

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Figure 1: Orion
(Source: www.fastcompany.com/1755184/meet-the-space-shuttle-successor-ovation-from-history)

Figure 2: Willingness of UB Students Regarding Space Exploration
(Blue = 3 years, red = 10+)

Figure 3: Biosphere 2
(Source: delawareonthemars2.com)